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Performance and Reliability of Wafer-bonded AlGaInP/mirror/Si Light-emitting Diodes

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Abstract

AlGaInP light emitting diode (LED) with a mirror substrate has been successfully fabricated by wafer bonding. The bonding technique using a metallic interlayer has been developed to eliminate handling the fragile, free-standing epilayers. Various structures of the mirror substrate have been studied, and a suitable structure of Au/AuBe/SiO₂/Si is proposed. From the observation of the chip fabrication process, it was found that the SiO₂ layer could isolate the stress causing from the Si substrate. The device performance of bonded LED is obviously far superior to that of the standard absorb-substrate LED. It exhibits normal p-n diode behavior with a low series resistance. Moreover, the emission wavelength of the bonded LED was independent of the injection current. The low forward series resistance and a good heat sink provided by Si substrate solve the joule heating inhering in conventional LED problem. Furthermore, the bonded LED with high reliability has been demonstrated.